

Claims:

## 1. An electrophoresis membrane support comprising:

a substantially planar member having four boundaries, an upper face and a lower face;

5 an inlet port disposed near one boundary;

an outlet port disposed opposite the inlet port near an opposite boundary;

spacers positioned between the inlet port and outlet port adapted to support a membrane positioned on the upper face or on the lower face of the member;

10 interstitial space disposed between the spacers capable of allowing flow of fluid therein;

inlet means in fluid communication with the inlet port and the interstitial space;

outlet in fluid communication with the interstitial space and the inlet port, the inlet and outlet means adapted to allow flow of fluid along the interstitial space;

first flow port disposed near one boundary; and

15 second flow port disposed opposite the first flow port near an opposite boundary, the first and second flow ports direct flow of fluid to or from the electrophoresis apparatus.

2. The support according to claim 1 wherein two supports are adapted to be assembled in an electrophoresis apparatus or cartridge to form transverse fluid flow paths along  
20 respective interstitial spaces formed by each support.

3. The support according to claim 1 or 2 wherein at least some of the inlet, outlet and flow ports are provided as channels formed in each respective boundary of the member.

4. The support according to claim 1 or 2 wherein at least some of the inlet, outlet and  
25 flow ports are formed as a plurality of ports or holes in the member.

5. The support according to claim 1 or 2 wherein the inlet and outlet ports are formed as non-circular ports to assist in movement of fluid in the port to enter the inlet or outlet means.

6. The support according to any one of claims 1 to 5 wherein the spacers are formed as  
30 a plurality of substantially planar parallel members running from the inlet means to the outlet means.

7. The support according to any one of claims 1 to 6 wherein the inlet means is formed by a series of flow channels directing fluid from the inlet port to the interstitial space.
8. The support according to any one of claims 1 to 7 wherein the outlet means is formed by a series of flow channels directing fluid from the interstitial space to the outlet port.
- 5 9. The support according to any one of claims 1 to 8 being substantially square in shape with the ports disposed near each of the four boundaries forming the square.
10. The support according to any one of claims 1 to 9 further comprising one or more drain ports.
11. The support according to claim 10 wherein the drain ports are in communication with  
10 drain channels adapted to receive fluid escaped from the ports or interstitial spaces.
12. An electrophoresis separation unit comprising:
  - a first manifold having at least one inlet port and one outlet port;
  - a second manifold having at least one inlet port and one outlet port;
  - a plurality of electrophoresis membrane supports according to any one of claims  
15 1 to 11 disposed between the first manifold and the second manifold; and
  - a plurality of ion-permeable membranes disposed between the membrane supports forming a plurality of adjacent flow chambers between the membranes;
  - wherein in use the direction of flow of fluid in one flow chamber is transverse to the direction of flow of another flow chamber.
- 20 13. The separation unit according to claim 12 having two membrane supports and three membranes forming a first flow chamber and a second flow chamber.
14. The separation unit according to claim 13 wherein the first manifold includes a first inlet port and first outlet port in fluid communication with the first chamber and a second inlet port and second outlet port in communication with the second chamber.
- 25 15. The separation unit according to any one of claim 13 wherein the second manifold includes a first inlet port and first outlet port in communication with the first chamber and a second inlet port and second outlet port in communication with the second chamber.
- 30 16. The separation unit according to any one of claims 12 to 15 further containing an electrode associated with both the first and second manifolds.

17. The separation unit according to claim 12 comprising:

a first manifold having a first inlet port and first outlet port, a second inlet port and second outlet port, and a third inlet port and a third outlet port;

a second manifold having an inlet port and outlet port;

5 a first ion-permeable membrane disposed adjacent the first manifold;

a second ion-permeable membrane disposed adjacent the first ion-permeable membrane;

a third ion-permeable membrane disposed adjacent the second manifold;

10 a first membrane support disposed between the first ion-permeable membrane and the second ion-permeable membrane;

a second membrane support disposed between the third ion-permeable membrane and the second ion-permeable membrane;

a first fluid chamber adapted to receive fluid in a first stream disposed between the first ion-permeable membrane and the second ion-permeable membrane;

15 a second fluid chamber adapted to receive fluid in a second stream between the second ion-permeable membrane and the third ion-permeable membrane;

a first electrolyte chamber containing a first electrode disposed between the first ion-permeable barrier and the first manifold; and

20 a second electrolyte chamber containing a second electrode disposed between the third ion permeable barrier and the second manifold;

25 wherein the first inlet port and first outlet port are in fluid communication with the first fluid chamber, the second inlet port and second outlet port are in fluid communication with the second fluid chamber, the third inlet port and third outlet port are in fluid communication with the first electrolyte chamber, and the inlet port and outlet port are in fluid communication with the second electrolyte chamber, and

wherein in use the direction of flow of the first stream is transverse to the direction of flow of the second stream.

18. The separation unit according to any one of claims 12 to 17 wherein at least one ion permeable membrane is a hydrogel membrane, an endo-electro-osmosis  
30 membranes capable of controlling the bulk movement of water, an isoelectric membrane, or a membrane having defined pore size or pore size distribution.

19. A membrane cartridge adapted to be positioned in an electrophoresis separation unit comprising:

a housing adapted to receive a plurality of ion-permeable membranes and a plurality of membrane supports according to any one of claims 1 to 11, the housing  
5 containing a membrane support, first inlet and first outlet ports, second inlet and second outlet ports, flow spacers and at least a first flow chamber and a second flow chambers; and

a retaining support adapted to retain the plurality of ion-permeable membranes and the plurality of membrane supports in the housing, the retaining support containing  
10 flow spacers;

wherein in use the direction of fluid flow in the first flow chamber is transverse to the direction of fluid flow of the second flow chamber.

20. Use of an electrophoresis membrane support according to any one of claims 1 to 11 in an electrophoresis apparatus, unit or cartridge.

15 21. A process for electrophoretic treatment of a sample comprising:

providing an electrophoresis separation unit according to any one of claims 12 to 18 in an electrophoresis system;

passing a sample through at least one flow chamber in the unit;

applying an electric potential; and

20 causing at least one component in the sample to pass through an ion-permeable membrane in the unit to an adjacent flow chamber.